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Date: November 20, 2000

Mr. Raymond Becker
Attorney at Law
324 Reading Road
Cincinnati, OH 45202

Re: Clifford Stevens Claim

Dear Mr. Becker,

I have examined the report of James M. Sunderlin to Mr. Edward E. Cooke dated May 15, 1999. I have visually examined the broken ladder and the remaining piece of the broken lock assmebly attached to the ladder. I have examined in greater detail using a Scanning Electron Microscope (SEM) the small piece of metal broken off from the lock assembly.

I have not made any attempts to remove the remaining piece of lock assmbly attached to the ladder (what is described as the left hand lock assembly in James M. Sunderlin's report), nor have I made any attempt to remove the good lock assembly (what is described as the right hand lock assembly in James M. Sunderlin's report) attached to the ladder. In this report I have analysed this ladder failure from a defective material point of view - particularly the aluminum alloy casting used for the (now-broken) lock assembly. We will have to disassemble the ladder in order to address some of the other issues. Based on the defective material theory, we may not have to do other examinations.

As indicated above, at this time I am limiting my analyses and recommendations solely based on the detailed examination of the broken piece of metal in the as-recieved condition. Visual examination of the fracture surface of the broken piece indicates a brittle fracture (usually signified by a flat granular looking fracture surface) of this piece with no indication of bending, shearing or tearing typical of a ductile fracture. Further examination under a SEM confirmed these findings. Electron micrographs presented in Photographs 1-4 show different regions of the fracture surface at a magnification of 50X. Conistently all these regions show (1) patterns of brittle fracture, (2) a number of cracks on the fracture surface and (3) inclusions. SEM micrograph 5 shows one of these regions at a magnification of 200X, which futher confirms the presence of the underlying cracks and inclusion particles on the fracture surface. Some high magnification close-up shots at 2,000X and 5,000X all indicate the sharp brittle features and the inclusion particles in SEM micrographs 6 and 7. Chemical analyses of these particles and the overall broken piece have been possible using Energy Dispersive Spectroscopic (EDS) analysis. For example, the particles seen in SEM micrograph 8 at a magnification of 1,500X were found to contain substantial amounts of oxygen in addition to the alloying elements of aluminum, copper, silicon and zinc. This is listed in the enclosed chart. Additionally, chemical analysis of the fracture surface at low magnification also indicated high oxygen content to indicate the presence of oxide

inclusions on the fracture surface. From the EDS analysis it is evident that the broken piece of metal is a casting made of aluminum, silicon, copper and zinc and that the high oxygen content detected comes from the inclusion particles detected on the fracture surface. The fracture surface shows a large volume fraction of oxide-type of inclusions.

In conclusion, the aluminum alloy casting failed in a brittle fashion and an important contributing factor for this brittle failure comes from the inclusion particles in the casting.

In addition to the above research, in an attempt to obtain standard practices in making ladders, I have been conducting a library search to find more information on standards and safety features recommended by the Consumer Product Safety Commission or other agencies. The reports I have managed to gather to date are included here. As I gather more reports, I'll pass them on to you.

Sincerely,

N. Jayaraman

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enclosures